Production of food-safe polylactic acid (PLA) through upcycling of sugarcane bagasse.

**Simultaneous Saccharification and Fermentation**
- Combined hydrolysis and fermentation: reduces cost
- Sugars instantly consumed: decreases cellulase inhibition
- *B. coagulans* utilizes both glucose & xylose: high yield
- *B. coagulans* produces only L-lactic acid: optically pure

**Lactide Synthesis**

<table>
<thead>
<tr>
<th></th>
<th>Polycaprolactone + Depolymerization</th>
<th>One-Step Synthesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical Purity</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Yield</td>
<td>55-75%</td>
<td>75-90%</td>
</tr>
<tr>
<td>Purity</td>
<td>80-955</td>
<td>95-97%</td>
</tr>
<tr>
<td>Catalyst Use</td>
<td>Liquid provided continuously</td>
<td>Solid replaced periodically</td>
</tr>
</tbody>
</table>

**POLYMERIZATION**
Lactide is converted to PLA by ring opening polymerization using a tin octoate catalyst in a batch reactor.

**POLYMERIZED PLA**
- 80 ppm Tin (IV) Oxide
- 30 kT/yr

**Environmental**
- 100% Biodegradable
- 1,768 TJ/yr Recovered
- 2.6M tonnes/yr Effluent
- 99.7%↓ than feedstock incineration
- 28%↓ than polypropylene production

**Economic**
- $163M Revenue per Year
- 16% Rate of Return
- 8 yrs Payback Period

**CAPEX**
- $66M
- Equipment Cost 22.12%
- Other Direct Costs 34.95%
- General Expenses 22.30%
- Raw Material 19.91%
- Plant Overhead Costs 7.50%
- Fixed Charges 5.60%
- Utilities 39.99%
- Laboratory 0.45%
- Potents and Royalties 3.00%
- Maintenance and Operation 5.61%

**OPEX**
- $144M

**Hanoi, Vietnam**
- 265 kT farm waste diverted
- 31.5 kT PLA produced

**Supplementary Information**
- Biodegradable
- 2.6M tonnes/yr
- 99.7%↓ than feedstock incineration
- 28%↓ than polypropylene production

**Polylactic Acid (PLA) Plastics from Sugarcane Bagasse**
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